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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|----------------------------|------------------|
| 09/888,261 | 06/21/2001 | Sergey Nikolskiy | 18563-003410 AT-00075.1 | 9129 |
| 46718 | 7590 | 10/20/2005 | EXAMINER | |
| TOWNSEND AND TOWNSEND AND CREW, LLP (018563) TWO EMBARCADERO CENTER, EIGHTH FLOOR SAN FRANCISCO, CA 94111-3834 | | | SHARON, AYAL I | |
| | | ART UNIT | PAPER NUMBER | |
| | | 2123 | | |

DATE MAILED: 10/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|------------------------|---------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 09/888,261 | NIKOLSKIY ET AL. |
| | Examiner | Art Unit |
| | Ayal I. Sharon | 2123 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 03 August 2005.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-15 and 17-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-15 and 17-44 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 03 August 2005 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

| | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>8/3/05</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

Introduction

1. Claims 1-15 and 17-44 of U.S. Application 09/888,261, originally filed on 06/21/2001, are currently pending.
2. This action is non-final.

Oath/Declaration

3. U.S. Patent 5,975,893 to Chishti et al., assigned to the assignee of the instant application, was cited as an X reference in the International Search Report that was provided by Applicants on 8/3/2005, but not cited on the accompanying IDS form.
4. Examiner has cited this reference on the accompanying PTO-892 form.
5. Applicants are reminded of their declaration, which acknowledges the duty to disclose to the Office all information known to the persons to be material to patentability as defined in 37 CFR 1.56.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
 - (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. The prior art used for these rejections is as follows:

9. U.S. Patent 5,975,893 to Chishti et al. (Henceforth referred to as "**Chishti**").

10. Yamani, S.M. et al. "A System for Human Jaw Modeling Using Intra-Oral Images". Proc. of the 20th Annual Conf. of the IEE Eng'g in Medicine and Biology Society. Nov.1, 1998. Vol.2, pp.563-566. (Henceforth referred to as "**Yamani**").

11. Bourke, Paul. "Coordinate System Transformation". June 1996. (Henceforth referred to as "**Bourke**").

12. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

13. Claim 1-3, 13-15, 17, and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chishti in view of Yamani.

14. In regards to Claim 1, Chishti teaches the following limitations:

Art Unit: 2123

1. A computer-implemented method for generating a computer model of one or more teeth, comprising:

receiving as input a digital data set of meshes representing the teeth;
(See Chishti, especially: col.9, line 43 to col.10, line 7)

selecting a curved coordinate system with mappings to and from a 3D space;
(See Chishti, especially: col.10, line 66 – col.11, line 42)

Chishti teaches (col.10, lines 31-34) that “individual teeth and other components will be ‘cut’.”

generating a function in the curved coordinate system to represent each tooth;
(See Chishti, especially: col.11, lines 39-50; col.13, lines 45-47; Fig.4A and associated text at col.12, lines 2-3)

However, Chishti does not expressly teach the following limitation:

and rendering a graphical representation of the teeth using the computer model wherein the rendering comprises rendering the teeth at a selected one of multiple orthodontic-specific viewing angles.

Yamani, on the other hand, does expressly teach this limitation (see Yamani, Fig.4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Chishti with those of Yamani, because “such a model will be a tremendous asset in dental training and teaching.” (Yamani, p.564, first para.)

15. In regards to Claim 2, Chishti teaches the following limitations:

2. The method of claim 1, further comprising displaying the computer model of the teeth using the function and the coordinate system.

(See Chishti, especially: col.11, line 58 – col.12, line 8; and Fig.4 and Fig.4A)

16. In regards to Claim 3, Chishti teaches the following limitations:

3. The method of claim 1, further comprising storing a compact coordinate system description and the function in a file representing a compressed version of the digital data set.

(Chishti, especially: col.10, lines 52-56.)

Examiner interprets that the “parallel set of digital data set … at a lower resolution” corresponds to the claimed “compressed digital representation.”

17. In regards to Claim 13, Chishti teaches the following limitations:

13. The method of claim 1, further comprising receiving an instruction from a human user to modify the graphical representation of the teeth and modifying the graphical representation in response to the instruction.
(See Chishti, especially: col.11, line 58 – col.12, line 8; and Fig.4 and Fig.4A)

18. In regards to Claim 14, Chishti teaches the following limitations:

14. The method of claim 13, further comprising modifying the selected data set in response to the instruction from the user.
(See Chishti, especially: col.11, line 58 – col.12, line 8; and Fig.4 and Fig.4A)

19. In regards to Claim 15, Chishti teaches the following limitations:

15. The method of claim 13, further comprising allowing a human user to select a tooth in the graphical representation and, in response, displaying information about the tooth.
(See Chishti, especially: col.11, lines 13-15 and lines 58-64)

20. In regards to Claim 17,

17. The method of claim 13, further comprising providing a user interface through which a human user can provide text-based comments after viewing the graphical representation of the teeth
(See Chishti, especially: col.14, lines 16-23)

21. In regards to Claim 19,

19. The method of claim 1, further comprising delivering data representing positions of the teeth at selected points along treatment paths to an appliance fabrication system for use in fabricating at least one orthodontic appliance structured to move the teeth toward final positions.
(See Chishti, especially: col.12, line 28 to col.13, line 26)

22. In regards to Claim 20,

20. The method of claim 1, further comprising detecting teeth collision using the curved coordinate system.
(See Chishti, especially: col.11, lines 3-21)

23. Claims 4-8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chishti in view of Yamani and further in view of Official Notice.

24. In regards to Claim 4, Chishti teaches the following limitations:

4. The method of claim 3, further comprising transmitting the file to a remote computer.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

25. In regards to Claim 5, Chishti teaches the following limitations:

5. The method of claim 4, further comprising displaying the computer model of the teeth using the function at the remote computer.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

26. In regards to Claim 6, Chishti does not expressly teach the following limitation:

6. The method of claim 4, wherein the file is transmitted over a network.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

27. In regards to Claim 7, Chishti teaches the following limitations:

7. The method of claim 6, wherein the network is a wide area network.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a wide area network (WAN).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

28. In regards to Claim 8, Chishti teaches the following limitations:

8. The method of claim 6, wherein the network is the Internet.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via the internet.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

29. In regards to Claim 18,

18. The method of claim 13, wherein rendering the graphical representation comprises downloading data to a remote computer at which a human viewer wishes to view the graphical representation.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via the internet.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

30. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chishti in view of Yamani and further in view of Bourke.

31. In regards to Claim 9, Chishti teaches a 3D model of the jaw, including the teeth (col.10, line 66 to col.11, line 3). Chishti also teaches that the user can remove individual teeth, as well as the use of “spline curves” in this operation (col.11, lines 39-50).

However, Chishti does not expressly teach use of the specific coordinate system claimed in the following limitation:

9. The method of claim 1, wherein the coordinate system is based on equation:
 $V = P(\phi, \theta) + R * \text{Direction}(\phi, \theta)$
where V is a corresponding point in three-dimensional (3D) space to (ϕ, θ, r) ,
 P and Direction are a vector functions expressed in terms of ϕ and θ .

Bourke, on the other hand, expressly teaches the use of a “spherical” / “polar” coordinate system in which a 3D coordinate space is defined by the following 3 parameters: ϕ , θ , and R .

The claimed formula $\{V = P(\phi, \theta) + R * \text{Direction}(\phi, \theta)\}$ is inherent to the spherical coordinate system because it is the representation of a vector in terms of angle $\{P(\phi, \theta)\}$ and magnitude $\{R * \text{Direction}(\phi, \theta)\}$.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Chishti with those of Bourke, because Bourke expressly teaches that “There are three prevalent coordinate

systems for describing geometry in 3 space: cartesian, cylindrical, and spherical (polar)."

32. In regards to Claim 10, Chishti teaches the following limitations:

10. The method of claim 9, wherein the P and Direction functions are selected to minimize a deviation between the tooth model and a parametric surface specified by the curved coordinate system and the function.

Chishti teaches that the parameters of the brace are optimized to fit the teeth as best possible. (See Chishti, especially: col.12, line 28 to col. 13, line 15))

33. In regards to Claim 11,

11. The method of claim 9, wherein P and Direction are different for incisors and molars.

It is inherent that incisors and molars have different locations, and therefore different coordinates, in a visual display of teeth in the mouth.

34. In regards to Claim 12, Chishti does not expressly teach the claimed limitations:

12. The method of claim 1, further comprising determining a radius value.

Bourke, on the other hand, expressly teaches the use of a "spherical" / "polar" coordinate system in which a 3D coordinate space is defined by the following 3 parameters: ϕ , θ , and R . Examiner interprets that "R" corresponds to applicants' claimed "radius".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Chishti with those of Bourke, because Bourke expressly teaches that "There are three prevalent coordinate systems for describing geometry in 3 space: cartesian, cylindrical, and spherical (polar)."

35. Claims 21-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chishti in view of Official Notice.

36. In regards to Claim 21, Chishti teaches the following limitations:

21. A computer-implemented method for communicating information on one or more teeth, comprising:
providing, at a first system, a 3-dimensional digital model for a set of one or more teeth;
compressing the 3-dimensional digital model at the first system to generate a compressed digital representation;
... generating a 3-dimensional digital model based upon the compressed digital representation at the second system.

Chishti teaches (col.10, lines 52-56) “parallel set of digital data set ... at a lower resolution” that Examiner interprets as corresponding to the claimed “compressed digital representation.”

However, Chishti does not expressly teach communicating the information via a network, as in the following limitations:

communicating the compressed digital representation from the first system to a second system over a network; and

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

37. In regards to Claim 22, Chishti teaches the following limitations:

22. The method of claim 21, wherein compressing the 3-dimensional digital model further comprises:
selecting a curved coordinate system with mappings to and from a 3D space;
and
generating a function in the curved coordinate system to represent each tooth in the set of teeth.

(See Chishti, especially: col.10, line 66 to col.11, 28; col.11, lines 39-50; col.13, lines 45-47; Fig.4A and associated text at col.12, lines 2-3)

38. Claims 23-36 all claim following limitations, differing only in the claimed size of the generated file:

The method of claim 21, wherein compressing the 3-dimensional digital model generates a file that is ... in size.

Chishti teaches the compression of the input data as follows (see Chishti, especially: col.10, lines 52-56.) Examiner interprets that the “parallel set of digital data set ... at a lower resolution” corresponds to the claimed “compressed digital representation.”

However, Chishti does not expressly teach the size of the generated files. It is inherent that compressed files come in various sizes, and that compressed files can be varied in size based on (1) the size of the original (uncompressed) file, and (2) the amount of compression.

39. In regards to Claim 37, Chishti teaches the following limitations:

37. The method of claim 21, wherein the communicating the 3-dimensional digital model further comprises generating an image of the 3-dimensional digital model.

(See Chishti, especially: col.10, line 66 to col.11, line 3)

40. In regards to Claim 38,

38. The method of claim 21, wherein the 3-dimensional model comprises five teeth.

Examiner finds the number of teeth represented to be a matter of design choice.

41. In regards to Claim 39,

39. The method of claim 21, wherein the 3-dimensional model comprises ten teeth.

Examiner finds the number of teeth represented to be a matter of design choice.

42. In regards to Claim 40, Chishti teaches the following limitations:

40. The method of claim 21, wherein the 3-dimensional model comprises a jaw.

(See Chishti, especially: col.10, line 66 to col.11, line 3)

43. In regards to Claim 41, Chishti teaches the following limitations:

41. The method of claim 21, wherein the 3-dimensional model comprises gingiva.

(See Chishti, especially: col.10, line 66 to col.11, line 3)

44. In regards to Claim 42, Chishti teaches the following limitations:

42. The method of claim 21, wherein compressing the 3-dimensional digital model comprises:

removing one or more sections of the 3-dimensional digital model that are not needed for creation of a tooth repositioning appliance.

(See Chishti, especially: col.10, line 66 to col.11, line 21)

45. In regards to Claim 43, Chishti teaches the following limitations:

43. The method of claim 21, wherein the compressed digital representation comprises a grid of points, wherein coordinates for each point in the grid of points are stored as integer values.

(See Chishti, especially: col.10, lines 48-65)

46. In regards to Claim 44, Chishti teaches the following limitations:

44. The method of claim 21, wherein the first system is a system used by a teeth treatment plan designer and the second system is a system used by a treating clinician.

(See Chishti, especially: col.12, line 28 to col.13, line 26)

Response to Amendment

Re: Drawings & Specification

47. Examiner finds that Applicants' amendments to the drawings and specification correct typographical errors but do not add any new matter.

Re: Double Patenting

48. Applicants have filed a Terminal Disclaimer of the instant application to issued patent 6,633,789. The double patenting rejections based on that patent are therefore withdrawn.

Re: Claim Rejections - 35 USC § 112

49. In regards to the 35 USC § 112 rejections of Claims 23-37, Applicant's arguments filed 8/3/05 (see pp.17-18) have been found to be persuasive.

50. All 35 USC § 112 rejections have been withdrawn.

Re: Claim Rejections - 35 USC § 102

51. In view of the IDS submitted on 8/3/2005, Examiner has applied new art rejections of claims 1-20 (and withdrawn the old rejections).

Re: Claim Rejections - 35 USC § 103

52. In view of the Applicant's amendment to the claims, submitted on 8/3/2005, Examiner has applied new art rejections to claims 21-41 (and withdrawn the old rejections).

53. New claims 42-44 necessitated new rejections.

Conclusion

54. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.
55. Carnaghan, R.M. "An Alternative to Holograms for the Portrayal of Human Teeth." 4th Int'l Conf. on Holographic Systems, Components and Applications. Sept. 15, 1993. pp.228-231.
56. Verstreken, K. et al. "An Image-Guided Planning System for Endosseous Oral Implants." IEEE Transactions on Medical Imaging. Oct. 1998. Vol.17, Issue 5. pp.842-852.
57. Paul, L. et al. "Digital Documentation of Individual Human Jaw and Tooth Forms for Applications in Orthodontics, Oral Surgery and Forensic Medicine." Proc. of the 24th Annual Conf. of the IEEE Industrial Electronics Society (IECON '98). Sept. 4, 1998. Vol.4, pp.2415-2418.
58. Gao, Jianxin et al. "3-D element Generation for Multi-Connected Complex Dental and Mandibular Structure." Proc. Int'l Workshop on Medical Imaging and Augmented Reality. June 12, 2001. pp.267-271.
59. Xia, James et al. "Three-Dimensional Virtual-Reality Surgical Planning and Soft-Tissue Prediction for Orthognathic Surgery." IEEE Transactions on Information Technology in Biomedicine. June 2001. Vol.5, Issue 2, pp.97-107.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a bi-week, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached at (571) 272-3749.

Any response to this office action should be faxed to (571) 273- 8300, or mailed to:

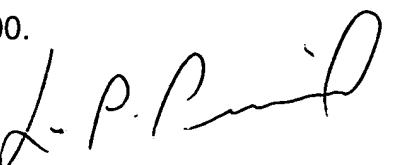
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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Tech Center 2100 Receptionist, whose telephone number is (571) 272-2100.

Ayal I. Sharon
Art Unit 2123
October 17, 2005



LEO PICARD
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100